

WE CLAIM:

1. An actuator comprising:
  - an electric motor that generates a back emf;
  - a control system for controlling the speed of the electric motor, the control system including:
    - a controller;
    - circuitry for allowing the controller to sample the back emf of the motor, wherein the controller uses the sampled back emf as feedback representative of motor speed for use in controlling the speed of the motor.
2. The actuator of claim 1, further comprising a motor drive circuit for driving the motor, wherein the controller turns off the motor drive circuit and allows current at the motor to decay to zero before sampling the back emf.
3. The actuator of claim 2, wherein the controller includes a pulse width modulator for controlling the motor drive circuit, the pulse width modulator providing a duty cycle having an on-time and an off-time. .
4. The actuator of claim 3, wherein the motor drive circuit is turned off for a period of time greater than the off-time of the duty cycle.
5. The actuator of claim 2, wherein the motor drive circuit is turned off for at least 2 ms to allow for current decay and for sampling.
6. The actuator of claim 5, wherein the motor drive circuit is turned off for at least 3 ms to allow for current decay and for sampling.
7. The actuator of claim 1, wherein the controller samples multiple back emf values and uses an average of the back emf values as feedback representative of motor speed.

8. The actuator of claim 1, wherein the electric motor includes a permanent magnet DC brush motor.
9. The actuator of claim 1, wherein the permanent magnet brush motor generates a back emf having a waveform, and wherein the controller samples multiple back emf values over a time period corresponding generally to one wavelength of the waveform.
10. The actuator of claim 9, wherein the controller uses an average of the sampled back emf values as feedback representative of motor speed.
11. The actuator of claim 9, wherein the controller samples at least 4 back emf values over a time period corresponding to one wavelength of the waveform.
12. The actuator of claim 9, wherein the controller samples at least 8 back emf values over a time period corresponding to one wavelength of the waveform.
13. The actuator of claim 9, wherein the controller samples at least 16 back emf values over a time period corresponding to one wavelength of the waveform.
14. The actuator of claim 1, wherein the motor is coupled to a damper vane.
15. The actuator of claim 1, wherein the motor is coupled to a valve.
16. The actuator of claim 1, wherein the motor includes first and second terminals, and wherein the circuitry for allowing the controller to sample the back emf of the motor includes a first conductive line that electrically connects the first terminal to the controller and a second conductive line that electrically connects the second terminal to the controller.

17. The actuator of claim 16, wherein the first and second lines each include at least one resistor.

18. The actuator of claim 17, wherein the first and second lines each include at least one capacitor.

19. A fluid flow control assembly comprising:

a permanent magnet DC brush motor that generates a back emf;

a control system for controlling the speed of the motor, the control system including:

a controller;

circuitry for allowing the controller to sample the back emf of the motor, wherein the controller uses the sampled back emf as feedback representative of motor speed for use in controlling the speed of the motor; and

a fluid flow control structure coupled to the motor.

20. The assembly of claim 19, wherein the fluid flow control structure includes a damper vane.

21. The assembly of claim 19, wherein the fluid flow control structure includes a valve.

22. The assembly of claim 19, further comprising a motor drive circuit for driving the motor, wherein the controller turns off the motor drive circuit and allows current at the motor to decay to zero before sampling the back emf.

23. The assembly of claim 22, wherein the motor drive circuit is turned off for at least 2 ms to allow for current decay and for sampling.

24. The assembly of claim 23, wherein the motor drive circuit is turned off for at least 3 ms to allow for current decay and for sampling.
25. The assembly of claim 19, wherein the controller samples multiple back emf values and uses an average of the back emf values as feedback representative of motor speed.
26. A method for controlling the speed of a permanent magnet DC brush motor, the method comprising:
  - supplying current to the motor to drive the motor at a first speed;
  - terminating the supply of current to the motor such that the current decays to zero;
  - after the current decays to zero, measuring the back emf generated by the motor; and
  - inputting the measured back emf into a speed control algorithm for controlling the speed of the motor, the measured back emf being representative the first speed.
27. The method of claim 26, further comprising re-supplying current to the motor after the back emf has been measured.
28. The method of claim 26, further comprising measuring the back emf by taking multiple back emf measurements while the supply of current is terminated, and inputting an average of the back emf measurements into the speed control algorithm.
29. The method of claim 28, wherein the back emf measurements are taken over a time period greater than 2 milliseconds.

30. The method of claim 28, wherein the back emf generates a waveform, and wherein the multiple back emf measurements are taken within a time period corresponding generally to one wavelength of the waveform.

31. A method for calibrating a speed control system for an electric motor, the method comprising:

- running the motor using a nominal value as a speed command ;
- measuring the motor speed generated by the nominal value; and
- using the ratio of the nominal value and the measured speed to calibrate the speed control system with respect to the motor.